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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

KIELIN, ERIK J

ART UNIT PAPER NUMBER

2813

DATE MAILED: 10/15/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/905,157

Applicant(s)

LEWIS ET AL.

Examiner

Erik Kielin

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 September 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-39 is/are pending in the application.
- 4a) Of the above claim(s) 6-8, 18-20 and 31-39 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-5, 9-17 and 21-30 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 5. 6) ☐ Other:

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DETAILED ACTION***Election/Restrictions***

1. Applicant's election with traverse of claims 4, 5, 16, 17, and 21-27 in Paper No. 8 is acknowledged. The traversal is on the ground(s) that, in spite of the patentable distinctness of the species, that it would not impose undue burden on Examiner to search and examine. This is not found persuasive because the species would require an divergent and burdensome search. In general, the species are directed --not just to the identity of the bonded organic layers, themselves, and the method of making such layers, as in elected species Group I-B-- but also to the use of the passivation layer in each of the following uses or devices: for controlling surface effects (classified in 257/ 629+; 438/780+); for use in a photovoltaic cell (257/225+; 438/57+); for use as a gate dielectric in a FET (257/324; 438/287); for use as part of a gate dielectric along with a high dielectric constant material (257/411; 438/591); for use bonded specifically to any of monocrystalline, polycrystalline, amorphous, or porous silicon (257/40; 257/52+; 438/769).

Moreover, Examiner notes that while different classifications are not required to demonstrate burden of search for patentably distinct *species*, as suggested by Applicant, the different classifications noted above clearly demonstrate such burden of search exists. Burden of search for the different *inventions* was already established by the different classifications. With the diversity of uses of the bonded organic layer claimed in the different species, the search of all appropriate class/subclass combinations for each species is considered burdensome.

The requirement is still deemed proper and is therefore made FINAL.

Nonetheless, in the interest of customer service, the restriction with respect to the species I-A and I-F through I-I is hereby withdrawn. In other words, only the claims drawn to the use of

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the organic layer in specific semiconductor devices (photovoltaic devices and field effect transistors) is being retained; that is claims 6-8 and 18-20. Accordingly, claims 1-5, 9-17, and 21-30 are active and will be examined.

2. Claims 31-39 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected invention, there being no allowable generic or linking claim. Claims 6-8 and 18-20 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected species, there being no allowable generic or linking claim.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1-5, 9-11, and 13-17, 21, 25-30 are rejected under 35 U.S.C. 102(b) as being anticipated by US 5,429,708 (**Linford et al.**).

Regarding claims 1 and 13, **Linford** discloses an electrical structure comprising a silicon-containing material 12 having a surface 40; and an organic monolayer 45 chemically bonded to the surface 40 of the silicon-containing material 12, wherein an electrical property of the electrical structure is seen to inherently be significantly changed compared to a same structure without the organic layer, as admitted by Applicant will happen and as indicated by **Linford** (col. 1, 21-31; paragraph bridging cols. 8-9).

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Regarding claims 2, 3, 14 and 15, as just noted the organic layer inherently affects the electrical property of the silicon-containing material, wherein any of the electrical properties is selected from a group consisting of surface recombination velocity, carrier lifetime, electronic efficiency, voltage, contact resistance, and resistance of a doped region. Evidence is the admission of Applicant and as indicated by **Linford**, as noted.

Regarding claim 4, the organic layer is a hydrocarbon (Fig. 4; col. 4, line 44 to col. 5, line 13).

Regarding claims 5, and 17, the organic layer is a polymer (Fig. 12; col. 5, lines 37-45).

Regarding claims 9-11 and 28-30, the silicon-containing material is monocrystalline, polycrystalline, amorphous, or porous (col. 1, lines 17-21).

Regarding claim 16, the organic layer is a monolayer (Figs. 3-12).

Regarding claims 21, the organic layer is formed by activating the surface of the silicon-containing material; and reacting the activated surface with a chemical, wherein during the reaction, a hydrocarbon group becomes chemically bonded to the silicon-containing material. (See col. 2, lines 6-45.)

Regarding claim 25, the hydrocarbon is an allyl, called "alkenyl" and structurally described as " $-C(R)=CH(R')$ " for example, in **Linford** (col. 5, lines 5-34).

Regarding claim 26, a polymer is formed by reaction with the surface-bound allyl group (col. 5, lines 37-46; paragraph bridging cols. 5 and 6).

Regarding claim 27, the hydrocarbon group is an alkoxide group (col. 4, lines 44-49; Fig. 5).

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5. Claims **13**, 21-24 are rejected under 35 U.S.C. 102(b) as being anticipated by JP 6-84853 A (**Tsukune** et al.).

Regarding claims 1-4, 13-16, and 21-24, **Tsukune** discloses activating a silicon-containing material (silicon, Si) by halogenating with HF (F is the halogen) and then reacting the activated silicon-containing material surface with a chemical (methanol) to chemically bond a monolayer of methyl groups to the silicon in the surface which has only 1 carbon atom. (See paragraphs [0010]-[0012], translation provided.) **Tsukune** teaches that the electrical property of, at least, voltage in the silicon is improved because defects are prevented in the contact between the tungsten or silicon deposited on the silicon-containing material (wafer) (paragraph [0018]).

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Linford** in view of US 3,961,353 (**Aboaf** et al.).

The prior art of **Linford**, as explained above, discloses each of the claimed features except for indicating the porosity to have an upper limit of 30%.

Aboaf teaches a semiconductor device having a porous layer of silicon **12**, wherein the silicon has a porosity of 15%. The silicon layer has a protective layer **15** formed there over to prevent oxidation in subsequent processes. (See col. 2, lines 41-61; col. 3, lines 3-13.)

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It would have been obvious for one of ordinary skill in the art, at the time of the invention to limit the porosity to no greater than 15% in order to form the device in **Aboaf**. Furthermore, the degree of porosity at no greater than 30% is an obvious matter of design choice and of routine optimization, depending upon the particular application of the porous silicon, at the suggestion of **Linford** to use porous silicon --especially since Applicant has provided no reason why the percentage porosity of the silicon bears any criticality to the formation of the organic layer.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Erik Kielin whose telephone number is 703-306-5980. The examiner can normally be reached on 9:00 - 19:30 on Monday through Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached at 703-308-4940. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9318 for regular communications and 703-872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.


Erik Kielin
October 9, 2002